1- Annealing is a process by which steel is reheated and then cooled to make it less brittle. Consider the reheat stage for a 100-mm-thick steel plate \((\rho = 7830 \text{kg/m}^3, c = 550 \text{J/kg.K}, k = 48 \text{W/m.K})\), which is initially at a uniform temperature of 200 °C and is to be heated to a minimum temperature of 550 °C. Heating is affected in a gas-fired furnace, where products of combustion at \(T_\infty = 800 \text{ °C}\) maintain a convection coefficient of \(h = 250 \text{W/m}^2.\text{K}\) on both surfaces of the plate. How long should the plate be left in the furnace.

2- A long bar of 70-mm diameter and initially at 90 °C is cooled by immersing it in a water bath that is at 40 °C and provides a convection coefficient of 20 W/m².K. The thermophysical properties of the bar are: \(\rho = 2600 \text{kg/m}^3, c = 1030 \text{J/kg.K}, k = 3.50 \text{W/m.K}\).
   
   (a) How long should the bar remain in the bath in order that, when it is removed and allowed to equilibrate while isolated any surroundings, it achieves a uniform temperature of 55 °C?
   
   (b) What is the surface temperature of the bar when it is removed from the bath.

3- Write a nodal equation for analysis of node \((m, n)\) in Figure to be used in a transient analysis of the solid.